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The duct runs straight forward along the dorso-lateral margin of the plastron, then back again, and, after many coilings, opens into a large irregular chamber, or end-sac, a remnant of the fifth coelomic cavity, situated in the middle of the posterior nephric lobe. The embryonic nephric duct develops as a tubular outgrowth of the ventral wall of this cavity. Its distal end finally unites with a short ectodermic ingrowth (readily distinguished in the adult), which opens at the base of the fifth leg.

The secretions from the four lobes of the gland are collected by gradually widening anastomosing tubules. Each lobe has many separate openings into the large tubules of the longitudinal stolon. The latter empty into the coelomic space, or end-sac, and from there a single nephric duct carries the secretions to the external opening at the base of the fifth leg.

The glandular portion of the kidney develops from six pairs of segmentally arranged 'anlagen.' Omitting all details, it may be stated that a part of the fifth coelomic cavity persists as the thin-walled chamber, or end-sac, mentioned above.

The other cavities of the thorax break down after producing, by a thickening of their neural walls, paired masses of finely granular cells. These cells become hollow and unite end to end to form irregular groups of anastomosing tubules. The longitudinal tubules of the stolon are formed in a similar manner by the union of outgrowths from each cluster of cells. Many tubes on the periphery of the gland retain this unicellular condition in the adult, but in the center of the lobes and in the longitudinal stolon the nuclei of the tubules have multiplied rapidly, giving rise to a lining endothelium of flattened cells.

The cell masses derived from the walls of the first and sixth coelomic cavities disappear. The remaining ones form the four lobes of the adult kidney.

The kidney of *Limulus* is, therefore, derived from segmentally arranged groups of excretory cells. Each group of cells probably emptied originally into its corresponding coelomic cavity, and from there to the exterior. These separate external openings have now disappeared, and the organs are united by longitudinal tubules which open by a single duct, or coelomic funnel, to the exterior.

I consider the kidney, the nephric duct and the genital duct of *Limulus* homologous, respectively, with the pronephros, the pronephric duct and the Müllerian duct of Vertebrates.

Many of the details of the above account were worked out in the biological laboratory at Dartmouth by Miss Annah P. Hazen. They will be fully described and illustrated in a joint paper that we hope will appear at an early date in the *Journal of Morphology*.

The Reaction of Amœba to Light of Different Colors and to Röntgen Rays. N. R. Harrington and Edward Leaming.

The physiological effect of Röntgen rays upon undifferentiated protoplasm is almost imperceptible as compared with the reaction produced by mechanical stimuli, heat, electricity or light.

We have found that *Amœba proteus* is extremely sensitive to changes in the color of light in which it is placed, and that it exhibits characteristic movements in different light environments.

The remarkably delicate condition of phototonus is, we think, dependent upon a favorable quality of light and an optimum temperature. Continuance in a given color produces a more or less characteristic flow; in violet a spasmodic, unsuccessful attempt to form pseudopods; in green or red a massive, diffuse bodily flow.

A quiescent *Amœba* brought from the room light into red light begins to flow in from ten to twenty-five seconds. The flow

becomes so rapid that photographs exposed one-fiftieth of a second show blurring, due to movement. On changing the red light to violet or mild white, streaming instantly stops and sometimes reverses. Swinging in green, red or yellow screens causes the flow to be resumed after an interval varying in different individuals from an almost imperceptible minimum to ten seconds. The following effect of any color was generally constant after the same preceding color, and as stimulants to flow the colors increased in effectiveness as one approached the red end of the spectrum, while as retarders of flow white light and the colors at the actinic end were most powerful.

The preceding experiments were performed by means of a large photomicrographic apparatus, the image of the *Amœba* being projected by an arc light upon the ground glass back. What little heat there was [24.8° C.] was equalized for the different colors by mica screens. Intensity was eliminated by adding more color screens, which diminished the brightness but seemed to accentuate the characteristic color effect, whether it was a retarding or a stimulating effect.

Stolonization in Autolytus varians. P. C. MENSCH.

As many as eight individual stolons have been observed in single chains of this species. The embryonic segments forming the stolons are derived as outgrowths from the last segment of the *parent stock*, which itself shows internal structures different from those of preceding segments. This process of segment formation contributes three or four segments to the future stolon, the posterior one of the series retaining its embryonic characters and forming the anal segment of the stolon. At the time the anterior of the three or four embryonic segments begin to thicken for the formation of the head a new segment appears anterior to the anal segment, and the future elongation of the stolon takes place by the separation of new segments from the anal segment.

The separation of the stolon takes place in a region of embryonic tissue which does not form part of a true segment, but which is derived from the undifferentiated tissues of the anal segment.

A wide range in the position of the chain exists in this species. In young specimens the chain is as far forward as the 19th segment of the parent stock, while in older and larger specimens it is placed as far posterior as the 59th segment, certain characters in the embryonic region of the chain indicating that, besides being active in the formation of stolons, this region also adds segments to the parent stock.

The cycle of stolonization in this species is: (1) The development of a first stolon on the young asexual individual by a process akin to fission. (2) The development of a chain of stolons from the last segment of the parent stock by budding. (3) The development of possibly a single stolon posterior to the middle region of the parent stock by true fission.

The Use of the Centrifuge for Collecting Plankton. G. W. FIELD.

HENSEN'S counting method is the present basis of quantitative and qualitative Plankton determinations. Yet improvements are desirable and feasible. The desideratum is a practical, rapid, simple method capable of general application, by which data can be obtained for use in determining the comparative economic value of all waters, either for scientific agriculture or for municipal water supplies. Counting of individuals and enumeration of species seem to be necessary, together with an accurate estimation of the volume of the inorganic matter and of the organic amorphous débris.

The chemical determination of the amount